Excerpt from June 2004 Fermilab Physics Advisory Committee Recommendations

P-942 Letter of Intent: FLARE – Fermilab Liquid Argon Experiments (Adam Para)

The Laboratory received a Letter of Intent from the FLARE (Fermilab Liquid Argon Experiments) collaboration. The LOI describes several possible future LAr TPC neutrino experiments, ranging from a 40-ton neutrino scattering experiment located underground in the NuMI beamline, to a 400-ton $0\nu\beta\beta$ experiment using ^{100}Mo cathode foils, to a very large 50-kton long-baseline LAr detector located on the surface in the off-axis NuMI neutrino beam. The LAr TPC detector technology has been pioneered by ICARUS, a 600-ton LAr detector that has been successfully tested and will take data in the CNGS (CERN to Gran Sasso) beamline. There are plans for an eventual upgrade to 2 kton. Several members of the ICARUS collaboration are also members of the FLARE collaboration.

The advantages of LAr technology for neutrino detection include high efficiency, fine-grained imaging, good energy resolution, and particle identification capabilities. The very high efficiency for electrons from ν_e appearance (~90%) combined with very good π^0 rejection would make this an excellent long-baseline neutrino detector. The main issues are the technical feasibility of such a big extrapolation over the existing ICARUS detector, and cost. An optimal neutrino detector will maximize the product of mass and efficiency divided by total cost.

The LOI requests a modest level of support for an R&D program with the goal of building a small, 100-liter, 80-cm drift LAr detector. The goals of the R&D program are to effect a technology transfer of LAr technology from ICARUS, to study materials and purification methods consistent with the proposed commercial liquefied gas cryogenic container, and to carry out further engineering studies leading to better cost estimates.

The Committee believes that the LAr TPC technology has great promise for future neutrino experiments, especially on the time scale of a future proton driver. However, there are significant technical issues associated with the construction, assembly, and operation of such a large volume of ultra-pure cryogenic liquefied gas. The Committee believes that a significant engineering investment is required in order to arrive at a more realistic design that can serve as the basis of a more reliable cost estimate that that presented in the LOI. The proposed modest program of R&D is a step in the right direction, but will not convincingly establish the feasibility of the proposed approach.